

# TELEPHONE FOR HAZARDOUS AREA

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**BORANG PENYERAHAN TESIS**

Judul: **TELEPHONE FOR HAZARDOUS AREA**

**SESI PENGAJIAN: 1997/2000**

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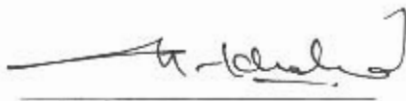
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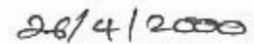
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This project attached hereto, entitled "Telephone for Hazardous Area". Prepared and submitted by Zakiah bt. Jerani as a partial fulfillment of the requirement for the degree of Bachelor of Engineering with honours (Electronics and Telecommunication) is hereby read and approved by



Mr. Al-Khalid Othman

Supervisor



Date

TABLE V

## TELEPHONE FOR HAZARDOUS AREA

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## ABSTRACT

The invention of telephone by Alexander graham Bell in the USA in 1876 led to the growth of the telephone system. Since then, the telephone set has emerged as one of the most widely use electrical devices in the world. Today, some changes and improvement have been made to the telephone set and circuitry to satisfy various needs and to be suited in different application. The objective of this project is to design and implement a telephone that can be used as a special intercommunication for mining area and hazardous area. This telephone is using push button (handsfree) to talk (noise reduction microphone) and ringing using beacons with 240volts.

The first chapter of this thesis consist of the introduction about the communication system and the history of the telephone, current technology in telephone and also the objective and overview of the project. The second chapter consists of the literature review, which focus on the telephone system and the instrument and circuit in the telephone set. The third chapter of this thesis discusses about the basic hardware component in the circuit design for the project. The fourth chapter consists of the design consideration and analysis of the project. The fifth chapter is the result and discussion of the project. The sixth chapter is the conclusion of the project.

## ABSTRAK

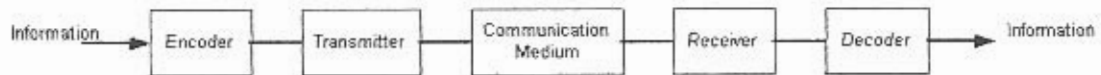
Penciptaan telefon oleh Alexander Graham Bell di Amerika pada tahun 1876 telah membawa perkembangan yang pesat didalam sistem telefon. Semenjak itu, telefon telah menjadi satu alat yang digunakan secara meluas diseluruh dunia. Pada masa kini, pelbagai perubahan dan kemajuan telah dilakukan terhadap litar dan set telefon supaya ianya dapat diaplikasikan didalam pelbagai bidang dan keadaan, seiring dengan kehendak dan permintaan. Objektif projek ini adalah untuk mereka dan menghasilkan telefon yang dapat digunakan sebagai pengantara komunikasi dikawasan lombong dan juga kawasan yang berbahaya. Telefon ini membolehkan penggunaanya menekan "push-button" untuk bercakap dan deringannya pula menggunakan 'beacon' 240Volt.

Bab pertama didalam tesis ini mengandungi pengenalan kepada sistem telekomunikasi, sejarah telefon, teknologi terkini didalam sistem telefon dan juga objektif projek. Bab kedua memfokuskan kepada kajian perpustakaan tentang sistem telefon, litar didalam telefon dan set telefon itu sendiri. Bab ketiga pula membincangkan tentang komponen asas yang digunakan didalam rekaan dan penghasilan litar untuk projek ini. Bab keempat membincangkan tentang perkara-perkara yang perlu diambilkira semasa menghasilkan litar dan juga analisisnya. Bab kelima pula membincangkan tentang keputusan dan perbincangan tentang projek. Dan akhir sekali bab enam pula mengandungi kesimpulan tentang projek secara keseluruhan.

## CHAPTER 1

### INTRODUCTION

Ever since individuals learned to communicate with others there has been a desire and a need to communicate faster, better and more reliably. The goal of communication is to send a message and distribute the information from one point to another and to ensure that the message is received properly and understood. Figure 1.0 illustrates the essential components of the communication system.



**Figure 1.0: Basic Components of a Communication System [4]**

Although communication may seem simple, it is not. In order to successfully send and receive a message, there are some factors to be considered. The factors involved are: -

- Nature of the information
- Format of the information
- Transmission speed
- Transmission medium
- Transmission distance
- Modulation technique
- Error control

The communications system can allow messages to pass in one direction only, in both directions at the same time, or in both direction but only one at a time. These are called simplex, full duplex, and half-duplex systems, and each has advantages and disadvantages.[4]

There are two types of communication systems; namely analog communication system and digital communication system. In the past, most communication systems transmitted voice information in analog form. Analog communications systems are used for sending inherently analog information, such as voice. They also can be used for sending analog information, which has been converted to digital form. An analog communication system is designed to handle a signal that can have any value within the total allowable range Many analog communications systems are in wide and successful use today.

The growth of communications for computer and digital system has created the need for system design to handle information, which generally exists not in analog form but in digital form. A digital system is designed to handle only digital signals, electrical signals that can take on only certain predefined values, instead of any value of the whole range. A digital communications system offers many advantages to the user that cannot be achieved with an analog system.[4]

Telecommunications is the term used to mean technology of communication at a distance. The term telecommunications is also used when the distance between the end of the communication systems is long enough to require a special link [4]. Today, telecommunications is a multibillion-dollar industry employing well over one million

people. This modern network handles voice and data communications efficiently and reliably in even the most remote location.

## **1.2 Background of Telephone System**

Telephone history begins at the start of human history. Man has always wanted to communicate from afar. People have used smoke signals, mirrors, jungle drums, carrier pigeons and semaphores to get a message from one point to another. But a phone is something new. The invention of telephone by Alexander Graham Bell in the USA in 1876 led to the growth of the telephone system. Since then, the telephone set has emerged as one of the most widely used electrical devices in the world.

The word telephone is derived from the Greek word *tele*, meaning far, and *phone* meaning sound [1]. A standard dictionary defines the telephone as "an apparatus for reproducing sound, especially that of the voice, at a great distance, by means of electricity; consisting of transmitting and receiving instruments connected by a line or wire which conveys the electric current.

Although the telephone and its system are things that most people take for granted. The telephone is one of the most amazing devices ever created. As a system, the telephone system is extremely complicated. There are many subtleties and advanced technology that makes this system work smoothly, efficiently and reliably on a country wide and worldwide basis [4]. In today's context, telephony involves the conversion of the sound signal into an audio frequency electrical signal which can then be transmitted over an electric transmission system and then reconverted to sound pressure signals at the receiver end. The electrical signals may be transmitted by radio or by wire, and a system

may well use both means to establish any given circuit. The wire telephone system was the earliest of such systems and still forms the backbone of modern communication.

Telephone systems may be categorized by the mode of transmission used. Most of the telephone system today is a full duplex communications systems that provides private two-way voice and data communication between any locations, separated by a few yards to thousand of miles. It was a means of transmitting sound especially voice over a distance, by converting sound vibrations into electrical signal which passed through wires as electrical signals, and were then reconverted to sound at the distant end. The telephone has come to have other benefits as well. The telephone network is now used not only for conversations, but nonvoice applications, too. For example, computer generated information is sent via telephone line whenever and wherever it is needed.

The telephone started as a single idea, but imagination and changing needs boosted it to become a system of diverse communication capabilities.

### **1.3 Current Technology in Telephone System**

The telephone system as it historically developed was designed for voice and analog signal. Many technical decisions and designs were implemented on that basis. Until now the telephone remains as one of the most universal methods in voice communications system, which is nothing more and nothing less than methods for allowing people to talk to one another over a short and long distances.

The telephone is changing and improving as mechanical and conventional electrical devices to electronic devices. The replacement by electronic devices is usually in the form of integrated circuit. These devices have most of the required components on



the chip, with connection provided for outboard components such as resistors and capacitors which are used to program the chip; that is to set the electrical operating parameters for specific application. In this way, one design can be used for a variety of similar, yet different requirements. Nowadays, most of the component in the telephone set has been replaced with equivalent integrated circuit. All of the circuit required to perform amplification, level detection, attenuation, switching and hybrid functions can now be fabricated on a single integrated circuit. This level of integration offers a smaller, more reliable circuit which is easier to assemble and test, as well as a whole new range of exists for the telephone at a tremendous cost saving.

In comparison from the earliest day of the telephone, there is not much different and changes in the telephone that we are using today except for the use of integrated circuit. This is because, the improvement to any part of telephone system must not be only better, more reliable, less expensive, but also it must be compatible with the existing system. The change in telephone industry is evolutionary, not revolutionary; subtle rather than sudden.

#### 1.4 Objective

In many instances it is not only the hard of hearing who are unable to hear the telephone ringing: even with normal hearing it is often impossible to detect it above the noise in the mining area. The objective of this project is to design and implement a telephone that enables the ringing of the phone to be seen with the aids of beacons with 240 volts. This telephone can also be used as a special intercommunication for mining area and in hazardous area. This telephone uses push button (handsfree) to talk (noise reduction microphone) which eliminate the need for a handset, although a handset is usually added for privacy and convenience. By adding this handsfree telephone, it is possible to speak to a caller from just about anywhere within a room.

## **CHAPTER 2**

### **LITERATURE REVIEW**

Understanding how the telephone system is used in communication and how to improve and make any changes to any part of the telephone system requires knowledge of the technical aspect of the telephone system.

#### **2.2 The Telephone Set**

Every telephone consists of three separate subassemblies, each capable of independent operation. These assemblies are the speech network, the dialing mechanism, and the ringer or bell. Together, these parts - as well as any additional devices such as modems, dialers, and answering machines are attached to the telephone line.

#### **2.3 Basic Functions of the Telephone Set**

The telephone set is designed to operate under a wide range of electrical, mechanical and acoustical conditions. Some of the basic functions of a telephone set are: -

1. It must notify the user of an incoming call through an audible tone such as a ring or bell.
2. It must transduce a caller's speech to electrical signals for transmission to a distant party through the system. Conversely, electrical signal received from a distant party must be transduced to audible speech signals for the called party.

3. A method of dialing subscriber numbers must be incorporated into the telephone set.  
This may be accomplished through dial pulses or tones.
4. The telephone set must regulate the speech amplitude of the calling party by compensating for the varying distances to the local telephone company, also known as the central office.
5. The telephone set must gain the attention of the central office when a user requests service by lifting the handset.
6. The telephone set must provide a nominal amount of feedback from its microphone to its speaker so that a user can hear himself speaking. This feedback is called sidetone. Sidetone regulates how loudly one speaks.
7. When the telephone set is not in use, an open circuit DC path must be provided to the central office.
8. In addition to receiving noise, the telephone set should also be capable of receiving call progress tones indicating the status (ringing, busy, etc) from the central office.

## **2.4 Local Loop**

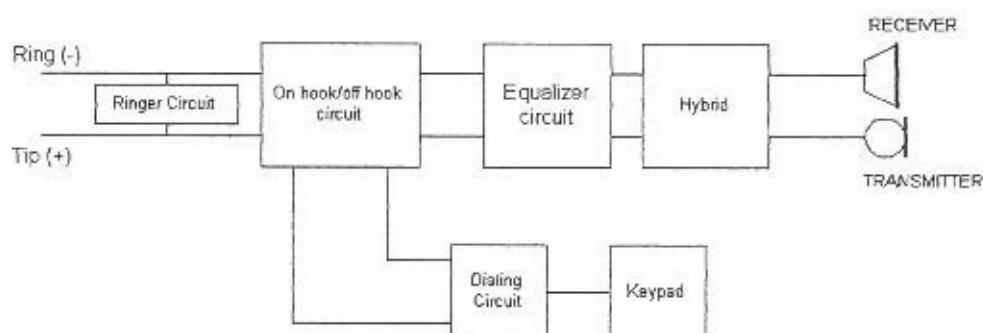
The phones system begins with the local loop, which is the pair of wires that connects each subscribers telephone to a central office that contains switching equipment, signaling equipment, and batteries that supply direct current to operate the telephone. The original local loop was one wire, and used the earth for the return path. This was too noisy and so two copper wires were introduced, to allow speech circuits to flow around. The function of the central office is to supervise the local loop and the phone connected to this loop, and to act as the interface between the phone and the rest of the system. This

requires that the central office monitor the phone line to see if the phone is hung up and idle (on-hook) or in use (off-hook), to send a dial tone, ringing signals, and other tones to the phone, to listen for dialing information from the phone and meet other interface needs, such as providing power to the phone.

## 2.5 Telephone Set Instruments

The elements of a telephone set are shown in figure 2.0 and the basic telephone set circuit is shown in figure 2.1. The telephone set consists of the following major component: -

1. Telephone ringer
2. Telephone receiver
3. Telephone switch
4. Telephone transmitter
5. Telephone hybrid
6. Telephone dialer



**Figure 2.0: Block Diagram of The telephone Set [2]**

Figure 1-2.  
Telephone Set and  
Central Office  
Exchange Simplified  
Circuits (Source: D. L.  
Cannon and G. Luecke,  
Understanding  
Communications  
Systems, SAMS, a  
Division of Macmillan  
Computer Publishing,  
1984)

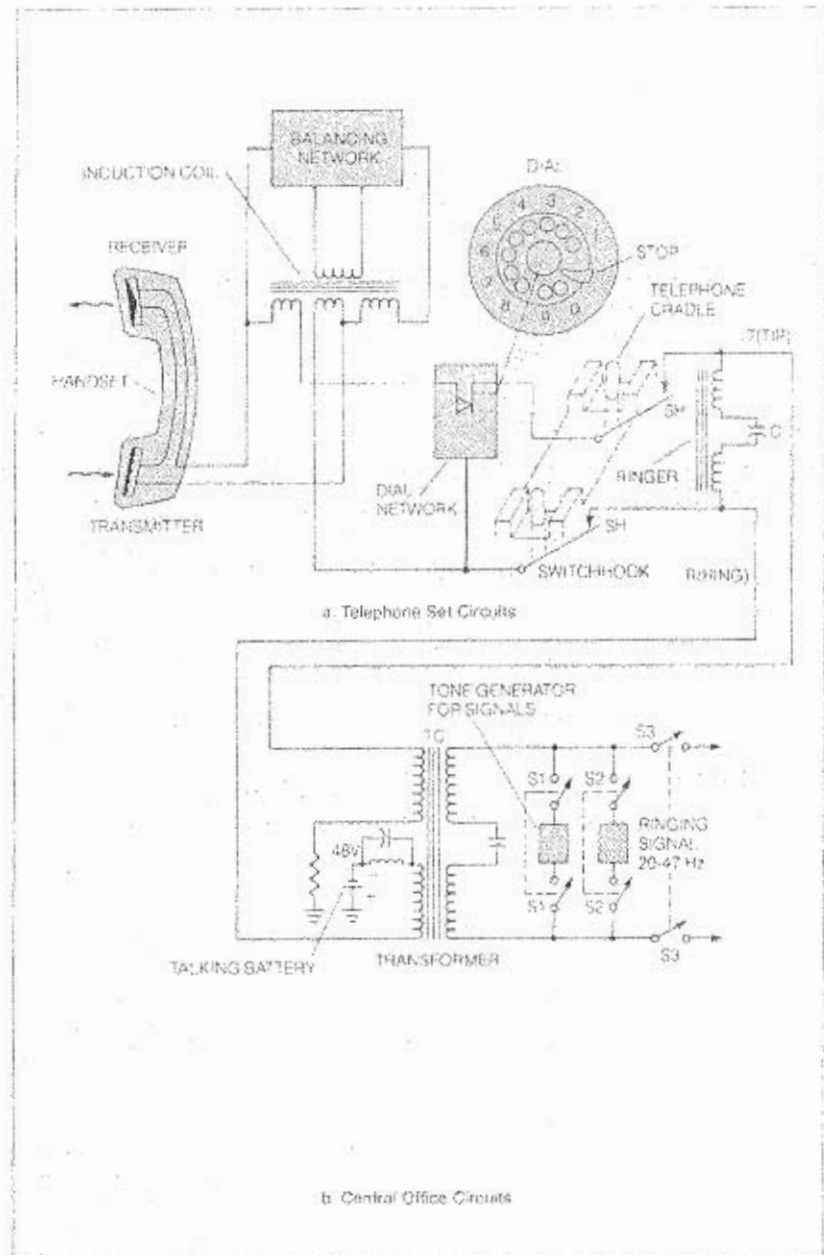


Figure 2.1: Basic Telephone Set Circuit [5]

## 2.6 Telephone Ringer

The ringer is a device that alerts the party of an incoming call. It may be a bell, light, or warbling tone. The audible tone must be loud enough for the party to hear from a distance. The Telephone Company sends a ringing signal, which is an AC waveform. Most of the world uses frequencies between 20 and 40 Hz. The voltage at the subscriber's end depends upon loop length and number of ringers attached to the line; it could be between 40 and 150 Volts. The most common ringing device is the gong ringer, a solenoid coil with a clapper that strikes either a single or double bell. Ringers are isolated from the DC of the phone line by a capacitor as shown in figure 2.1. It is used to block DC current and pass the ac ringing current. Its value, combined with the coil inductance, is selected to provide a high impedance to voice frequencies. [2]

A gong ringer is the loudest signaling device that is solely phone-line powered. Modern telephones tend to use warbling ringers, which are usually ICs powered by the rectified ringing signal. The audio transducer is either a piezoceramic disk or a small loudspeaker via a transformer. Warbling ringers tend to draw less current than gong ringers, so changing from gong ringers to warbling ringers may help to spread the sound better. The capacitor and ringer coil, or Zeners in a warbling ringer constitute a resonant circuit. When the telephone is on hook the ringer is across the line; if the ringer is turned off, the transducer is merely silenced; not removed the circuit from the line. Gong ringers in the United States use a  $0.47\mu\text{F}$  capacitor. Warbling ringers in the United States generally use a  $1.0\mu\text{F}$  capacitor. Telephone companies in other parts of the world use capacitors between 0.2 and  $2.0\mu\text{F}$ . The paper capacitors of the past have been replaced

almost exclusively with capacitors made of Mylar film. Their voltage rating is always 250 Volts.[2]

## **2.7 Telephone Transmitter**

The transmitter for telephone set is essentially a microphone. It is the part of the handset into which the person speaks. Telephone transmitters have been designed using numerous techniques to convert sound impinging or acoustical energy, generated from speech onto the transmitter into electrical energy, which is transmitted onto the subscriber loop. Carbon granule transmitters were very common from the earliest day of telephony until comparatively recently. Modern telephones use electret microphones for transmitters.

In a carbon granule transmitter, DC current provided by the telephone system is passed through two electrodes separated by thousands of carbon granules. One electrode is attached to a diaphragm that vibrates in response to the acoustical pressures of sound. The opposite electrode is supported by the handset molding. Vibration of the diaphragm causes the contact resistance between the two electrodes to vary inversely with pressure. As the resistance varies, the current varies inversely, thereby translating the acoustical message into the electrical signal that is transmitted to the central office. The central office, in turn, routes the electrical signal to its destination. The electret microphone uses the same principles. Sound waves picked up by an electret microphone causes a thin, metal-coated plastic diaphragm to vibrate, producing variations in an electric field across a tiny air gap between the diaphragm and an electrode.